

DOCKET NO: 291685US0X PCT

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :
DAGMARA ORTMANN, ET AL. : EXAMINER: NWAONICHA, C. O.
SERIAL NO: 10/584,148 :
FILED: JUNE 22, 2006 : GROUP ART UNIT: 1621
FOR: METHOD FOR PRODUCING :
TRIVALENT ORGANOPHOSPHORUS
COMPOUNDS

APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

This is an appeal of the Final Rejection dated April 29, 2008 of Claims 1-17. A
Notice of Appeal is **submitted herewith**.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is EVONIK OXENO GmbH, having an
address at Paul-Baumann-Strasse 1, 45772 Marl, Germany.

II. RELATED APPEALS AND INTERFERENCES

Appellants, Appellants' legal representative and the assignee are aware of no appeals
or interferences which will directly affect or be directly affected by or have a bearing on the
Board's decision in this appeal.

III. STATUS OF THE CLAIMS

Claims 1-17 stand rejected and are herein appealed.

IV. STATUS OF THE AMENDMENTS

No amendment under 37 CFR 1.116 has been filed.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

A summary of the claimed subject matter, as claimed in sole independent Claim 1, is mapped out below, with reference to page and line numbers in the specification added in **[bold]** after each element.

A process for preparing trivalent organophosphorus compounds by condensing phosphorus compounds of the formula i



where Hal is a halide selected from chlorine, bromine and iodine and may be the same or different when a plurality of halides are present ($a > 1$), R is an organic radical bonded to the phosphorus via a carbon or oxygen atom, and, when $a < 2$, the R radicals present may be the same or different, and a is a number from 1 to 3, **[page 4, lines 22-29]**

with organic compounds that have at least one OH group, **[page 4, line 30]**

the process comprising carrying out the condensation reaction in the presence of at least one basic ion exchange resin. **[page 4, lines 30-31]**

VI. GROUNDS OF REJECTION

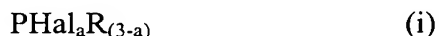
Claims 1-17 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Gatrone et al, "The Synthesis and Purification of the Carbamoylmethylphosphine Oxides," in SOLVENT EXTRACTION AND ION EXCHANGE, 5(6), 1075-1116 (1987) (Gatrone et al)

in view of Martin, “Facile Reduction in the Synthesis of Phosphorylcholine Affinity Columns,” in Tetrahedron Letters, Vol. 37, No. 44, pp. 7921-7924 (1996) (Martin), and additionally on US 4,885,401 (Billig et al) and US 2002/0111487 (Roettger et al).¹

VII. ARGUMENT

Claims 1-17 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Gatrone et al in view of Martin, and additionally on Billig et al and Roettger et al. The rejection is untenable and should not be sustained.

As recited in sole independent Claim 1, an embodiment of the present invention is a process for preparing trivalent organophosphorus compounds by condensing phosphorus compounds of the formula i



where Hal is a halide selected from chlorine, bromine and iodine and may be the same or different when a plurality of halides are present ($a > 1$), R is an organic radical bonded to the phosphorus via a carbon or oxygen atom, and, when $a < 2$, the R radicals present may be the same or different, and a is a number from 1 to 3, with organic compounds that have at least one OH group, **the process comprising carrying out the condensation reaction in the presence of at least one basic ion exchange resin.**

(Emphasis added.)

As described in the specification beginning at page 1, lines 8, organophosphorous compounds have gained considerable industrial importance, and a large number of

¹ That the new prior art, i.e., Billig et al and Roettger et al, is not listed in the statement of the rejection is irrelevant; reliance thereon is all that is necessary. “Where a reference is relied on to support a rejection, whether or not in a ‘minor capacity,’ there would appear to be no excuse for not positively including the reference in the statement of rejection.” *In re Hoch*, 428 F.2d 1341, 166 USPQ 406, 407 n.3 (CCPA 1970). See also MPEP 706.02(j).

preparative processes has been developed. Various methods have been disclosed for preparing trivalent organophosphorous compounds by condensing phosphorous compounds of the formula (i) of Claim 1, as excerpted above, which compounds can be characterized as halophosphines, halophosphites, halophosponites, or halophosphinites, depending upon whether R is bonded to the phosphorous via a carbon atom or an oxygen atom, and the value of "a".

Applicants have described various disadvantages of the prior art processes, as described in the specification at page 4, lines 5-10, such as the complete removal of the base used from a target product as costly and inconvenient; salts formed in the reaction of the bases used are frequently voluminous or occur in a particle size distribution which complicates the removal by filtration; and the maintenance of the desired reaction temperature is difficult owing to high exothermicity.

The present invention addresses these disadvantages and, as described in the specification at page 4, lines 15-20, the objectives are obtained surprisingly despite the use of a heterogeneous substrate to scavenge the hydrogen halide being formed, there being no losses in yield.

Gatrone et al is drawn to a study of synthesis and purification of symmetrical and unsymmetrical carbamoylmethylphosphine oxides. The Examiner appears to rely on the disclosure therein of bis(2-N-hexyloxyethyl)(phenyl)phosponite (page 1080), which is described as being prepared by reacting dichloro(phenyl)phosphine with 2-N-hexyloxyethanol. However, Applicants do not dispute that such a reaction is known in the art. The Examiner relies also on the disclosure therein (Abstract) which relates to the above-described synthesis and purification, including the use of acidic and basic ion exchange resins for the removal of acidic impurities. However, the use of such ion exchange resins for the removal of impurities after the reaction has been conducted is irrelevant to the presently-

claimed process, wherein the at least one basic ion exchange resin is present during the carrying out of the condensation reaction.

Martin does not remedy the above-discussed deficiencies in Gatrone et al. The Examiner relies on Martin's disclosure of reacting a particular halogenated phosphorus compound with a hydroxyl compound in the presence of a basic ion exchange resin (page 7922). However, the particular reaction disclosed by Martin involves the reaction of 4-nitrophenylphosphorodichloridate, which is a compound containing a P=O group, and which compound is different from, and not suggestive of, the particular dichloro(phenyl)phosphine of Gatrone et al., which contains no O moiety, let alone a P=O group. In other words, there is no disclosure or suggestion in any of the applied prior art that one skilled in the art would equate these structurally different phosphorus compounds for any reason. Note that none of the starting or final phosphorus compounds of the present invention have a P=O group.

In the Final Rejection, the Examiner has responded to our arguments by simply asserting that since the claimed process produces hydrogen halide, it would have been obvious to include a basic ion exchange resin during the condensation reaction to scavenge the hydrogen halide, while ignoring all our other arguments. The Examiner relies on Billig et al and Roettger et al as disclosing the use of a base to capture HCl generated by a reaction of a halogenated phosphorus compound and a hydroxyl compound.

In reply, the Examiner apparently believes that in the condensation reaction as claimed, the function of a basic ion exchange resin and that of a basic compound, such as a tertiary amine would be the same, just to capture HCl generated in the reaction. This is clearly not true.

In a condensation reaction, normally basic reaction conditions, provided by the addition of a base, are needed to perform the reaction by splitting off acidic hydrogen and halogen from the precursor compounds to be condensed and immediately neutralizing the

generated acid in the form of the salts with the base, as discussed above and as described in the specification. Indeed, the specification describes advantages in the use of a basic ion exchange resin compared to that of a basic compound, at page 5, lines 2-22.

In the condensation reaction as claimed, basic reaction conditions and the presence of basic compounds would be highly undesirable because of side reactions and further reactions of the target organo phosphorous compounds under basic conditions. Furthermore, the salts generated and more or less dissolved in the reaction mixture are hard to separate off.

In the condensation reaction as claimed, **acidic** reaction conditions are maintained also in the presence of the basic ion exchange resin. Such acidic reaction conditions are inherent due to the nature of the compounds of formula i. A basic compound, if present, would react directly with these halogenated phosphorus compounds and the OH-containing compound in the liquid phase by splitting off hydrogen and halogen, and neutralize the acid. In the present invention, acid generated by the reaction (without a base) has to migrate to and into the solid phase ion exchanger to be trapped and neutralized there.

A base is not needed to split off the acid – which is an astonishing finding. The function of the basic ion exchange resin is completely different from that of a base, which is simply to absorb and neutralize the acid generated during the condensation reaction in the resin.

Claim 5

Claim 5 is separately patentable, since the above combination of references, in addition to not disclosing the compounds recited in Claim 4, neither disclose nor suggest initially preparing them by charging the phosphorus compound together with one or more basic ion exchange resins and subsequently metering in the compound having an OH group.

Claim 13

Claim 13 is separately patentable, since the above combination of references, neither discloses nor suggests any details about a ion exchanger, let alone one in the form of particles having an average particle size of from 10 μ m to 2 mm or in the form of a fixed package.

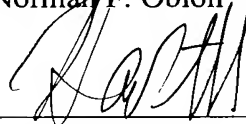
For all the above reasons, it is respectfully requested that this rejection be REVERSED.

VIII. CONCLUSION

For the above reasons, it is respectfully requested that the rejections be REVERSED.

Respectfully submitted,

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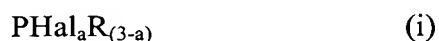
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CLAIMS APPENDIX

Claim 1: A process for preparing trivalent organophosphorus compounds by condensing phosphorus compounds of the formula **i**

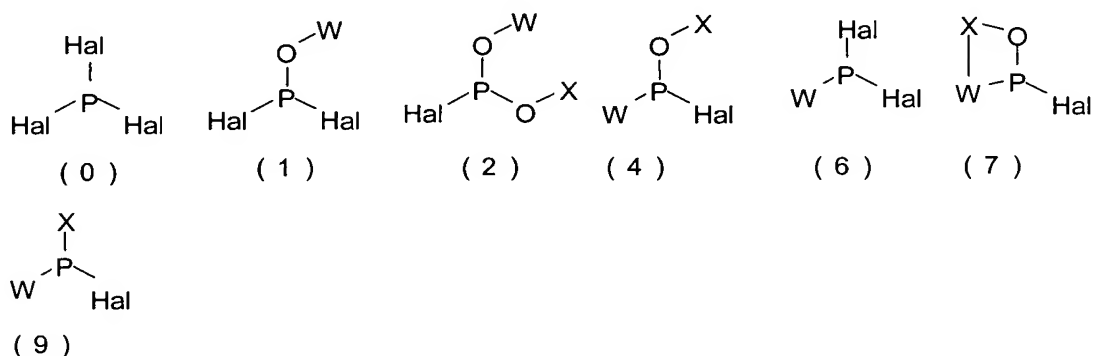


where Hal is a halide selected from chlorine, bromine and iodine and may be the same or different when a plurality of halides are present ($a > 1$), R is an organic radical bonded to the phosphorus via a carbon or oxygen atom, and, when $a < 2$, the R radicals present may be the same or different, and a is a number from 1 to 3,

with organic compounds that have at least one OH group,

the process comprising carrying out the condensation reaction in the presence of at least one basic ion exchange resin.

Claim 2: The process of claim 1, wherein the phosphorus compound of the formula **i** used is at least one compound selected from the compounds of the following formulae

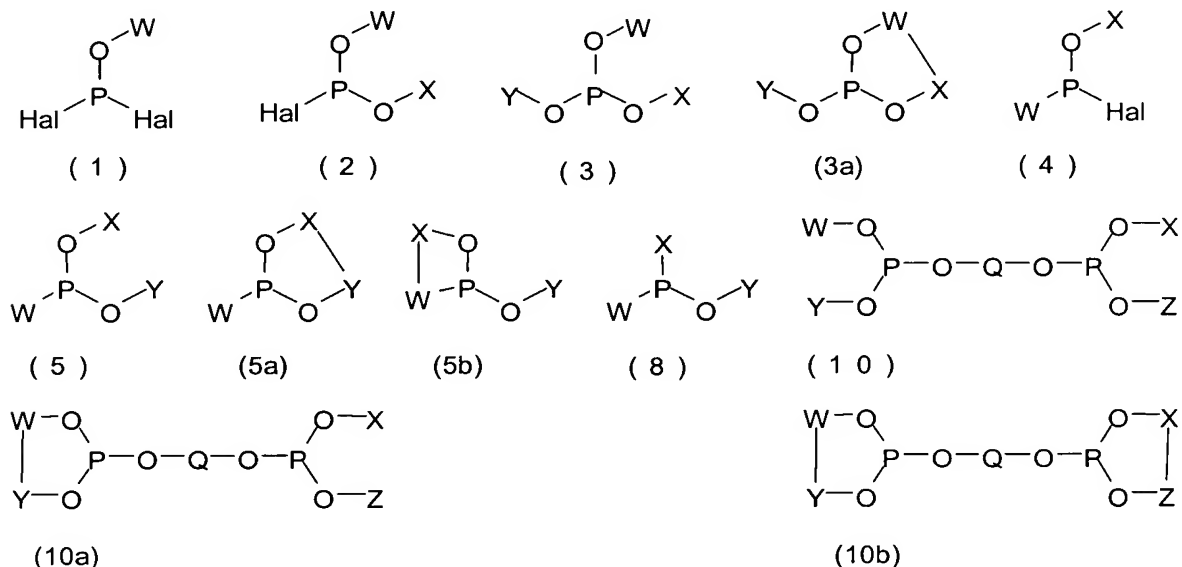


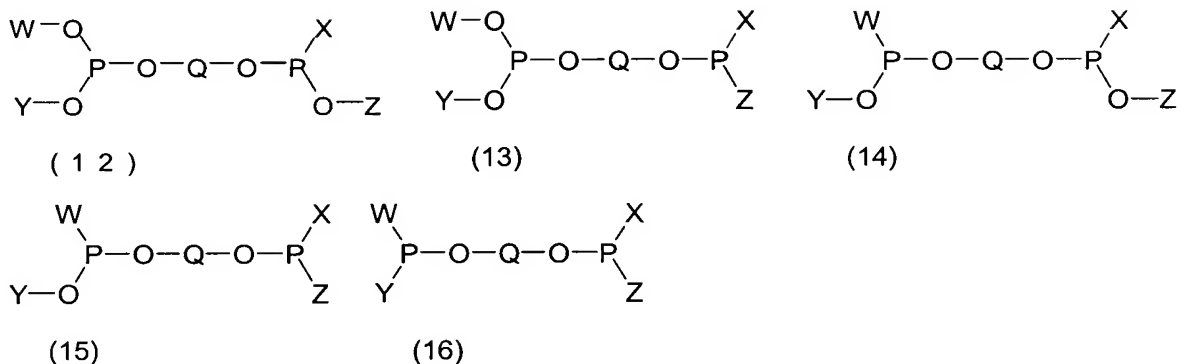
where W and X are substituted or unsubstituted, aliphatic, alicyclic, aliphatic-alicyclic, heterocyclic, aliphatic-heterocyclic, aromatic-aromatic or aliphatic-aromatic

hydrocarbons having from 1 to 50 carbon atoms, and W or X are the same or different or covalently joined together.

Claim 3: The process of claim 1, wherein the compound used that has at least one hydroxyl group is at least one substituted or unsubstituted compound selected from methanol, ethanol, n-propanol, isopropanol, 1-butanol, 2-butanol, t-butanol, 2-ethylhexanol, isononanol, isodecanol, isotridecanol, phenol, phenol derivatives, 1,4-dihydroxybenzene, 1,2-dihydroxybenzene, 1,8-dihydroxynaphthalene, 1,1'-binaphthyl-2,2'-diol or 2,2'-binaphthyl-1,1'-diol, and the substituted compounds may have substituents selected from primary, secondary and tertiary alkyl groups, alicyclic groups, aromatic groups, $-N(R^5)_2$, $-NHR^5$, $-NH_2$, fluorine, chlorine, bromine, iodine, $-CN$, $-C(O)-R^5$, $-C(O)H$ or $-C(O)O-R^5$, $-CF_3$, $-O-R^5$, $-C(O)N-R^5$, $-OC(O)-R^5$ and/or $-Si(R^5)_3$, where R^5 is a monovalent hydrocarbon radical, and, when a plurality of hydrocarbon radicals R^5 is present, they are the same or different.

Claim 4: The process of claim 1, wherein the trivalent organophosphorus compound prepared is at least one compound selected from the compounds of the following formulae





where W, X, Y and Z are each substituted or unsubstituted, aliphatic, alicyclic, aliphatic-alicyclic, heterocyclic, aliphatic-heterocyclic, aromatic-aromatic or aliphatic-aromatic hydrocarbon radicals having from 1 to 50 carbon atoms, and W, X, Y and Z are the same or different or covalently joined together, and where Q is an at least bivalent, substituted or unsubstituted, aliphatic, alicyclic, aliphatic-alicyclic, heterocyclic, aliphatic-heterocyclic, aromatic, aromatic-aromatic or aliphatic-aromatic hydrocarbon radical.

Claim 5: The process of claim 4, wherein the compounds of the formulae (1), (2), (3), (3a), (4), (5), (5a), (5b) or (8) are each prepared by initially charging the phosphorus compound together with one or more basic ion exchange resins and subsequently metering in the compound having an OH group.

Claim 6: The process of claim 4, wherein asymmetric diphosphorus compounds are prepared by initially charging the compound having OH groups together with one or more basic ion exchange resins and subsequently metering in the phosphorus compound.

Claim 7: The process of claim 1, wherein the reaction of in each case a compound that has at least one phosphorus-halogen bond with a compound having at least one hydroxyl group is one reaction step.

Claim 8: The process of claim 7, wherein, when a plurality of reaction steps is carried out, they may be carried out continuously or batchwise.

Claim 9: The process of claim 7, wherein, when a plurality of reaction steps is carried out, the same or different ion exchangers are used in the reaction steps.

Claim 10: The process of claim 7, wherein, when a plurality of reaction steps is carried out, the same or different temperatures are set in the reaction steps.

Claim 11: The process of claim 1, which is carried out in the presence of one or more solvents that are selected from the group of benzene, chlorobenzene, toluene, xylenes, pentane, n-hexane, n-heptane, cyclohexane, methylcyclohexane, diethyl ether, diisopropyl ether, methyl tert-butyl ether, anisole, tetrahydrofuran, 1,4-dioxane, 1,3-dioxolane, ethyl acetate, isobutyl acetate, tert-butyl acetate, ethylene carbonate, propylene carbonate, 1,2-butylene carbonate, acetone, 2-butanone, 3,3-dimethyl-2-butanone, benzonitrile, propionitrile, acetonitrile, lactones, N-methylpyrrolidone, dimethylformamide, dimethyl sulfoxide, N-alkylmorpholines and sulfolane.

Claim 12: The process of claim 1, which is carried out in the presence of polymeric, weakly basic ion exchange resins based on styrene-divinylbenzene copolymers that bear N,N-dialkylamine groups.

Claim 13: The process of claim 1, wherein the ion exchanger is used in the form of particles having an average particle size of from 10 μm to 2 mm or in the form of a fixed package.

Claim 14: The process of claim 1, wherein the ion exchanger is dried before use in the process.

Claim 15: The process of claim 1, which is carried out in the presence of a proton transferrer.

Claim 16: The process of claim 1, wherein the at least one basic ion exchange resin is present such that the ratio of moles of acid resulting from the release in moles to moles of free base released by the ion exchange resin is from 1:1 to 3:1.

Claim 17: The process of claim 1, wherein the at least one basic ion exchange resin is present such that the ratio of moles of acid resulting from the release in moles to moles of free base released by the ion exchange resin is from 1:1 to 2:1.

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EVIDENCE APPENDIX

None.

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RELATED PROCEEDINGS APPENDIX

None.